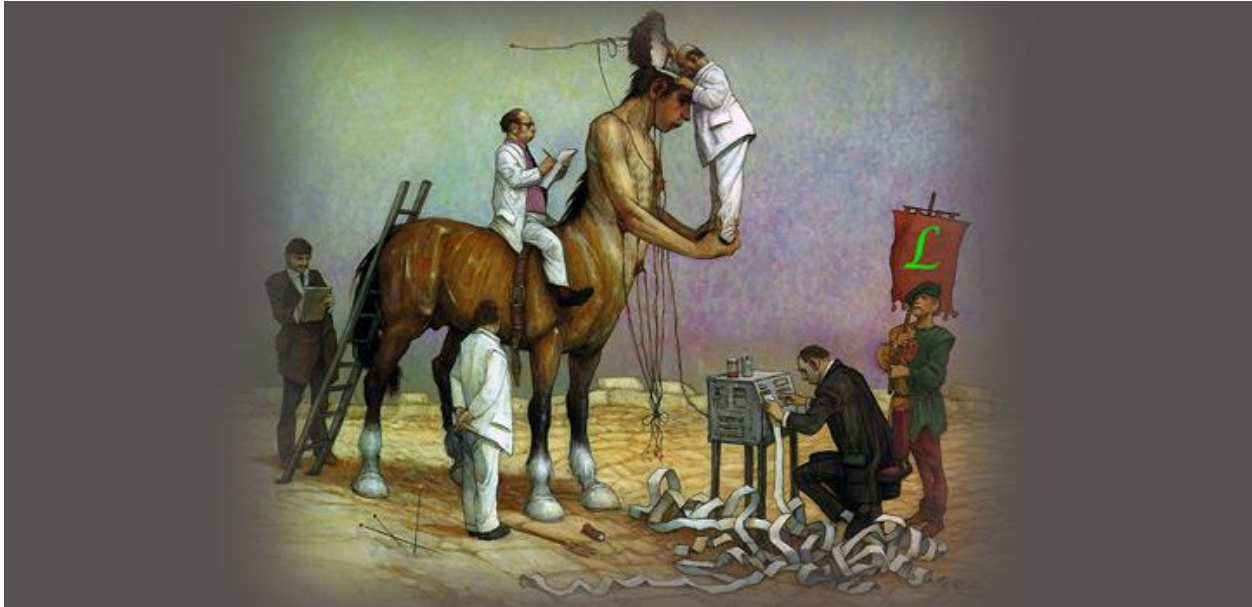


# Organic Systems, Mechanical Systems, The Dependency of The Mechanical on The Organic, and Parasystems

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(Levin, 2024)

In their thought-provoking essay, “Living Things Are Not (20th Century) Machines: Updating Mechanism Metaphors in Light of the Modern Science of Machine Behavior,” Joshua Bongard and Michael Levin argue for the following claims:

One of the most useful metaphors for driving scientific and engineering progress has been that of the “machine.” Much controversy exists about the applicability of this concept in the life sciences. Advances in molecular biology have revealed numerous design principles that can be harnessed to understand cells from an engineering perspective, and build novel devices to rationally exploit the laws of chemistry, physics, and computation. At the same time, organicists point to the many unique features of life, especially at larger scales of organization, which have resisted decomposition analysis and artificial implementation. Here, we argue that much of this debate has focused on inessential aspects of machines—classical properties which have been surpassed by advances in modern Machine Behavior and no longer apply. This emerging multidisciplinary field, at the interface of artificial life, machine learning, and synthetic bioengineering, is highlighting the inadequacy of existing definitions. Key terms such as machine, robot, program, software, evolved, designed, etc., need to be revised in light of technological and theoretical advances that have moved past the dated philosophical conceptions that have limited our understanding of both evolved and designed systems. Moving beyond

contingent aspects of historical and current machines will enable conceptual tools that embrace inevitable advances in synthetic and hybrid bioengineering and computer science, toward a framework that identifies essential distinctions between fundamental concepts of devices and living agents. Progress in both theory and practical applications requires the establishment of a novel conception of “machines as they could be,” based on the profound lessons of biology at all scales. We sketch a perspective that acknowledges the remarkable, unique aspects of life to help re-define key terms, and identify deep, essential features of concepts for a future in which sharp boundaries between evolved and designed systems will not exist. (Bongard and Levin, 2021: abstract)

I agree with most of the core content of Bongard’s and Levin’s argument, but also think that what I’ll call their “new-age mechanist” conclusion is in fact a *non sequitur*.

Why? Well, temporarily bracketing Bongard’s and Levin’s argument, what *is* the fundamental distinction between organic systems and mechanical systems? According to my view, the term *organic* means *non-mechanical*, not specifically *organismic*: all organisms are organic systems, but not all organic systems are organisms. Indeed, some organic systems are *formal* systems, whether logical or mathematical, and not specifically *natural* systems. By a *mechanical system* I mean any natural system such that it’s Turing-computable, entropic, reversible, time-bidirectional or time-symmetric, and equilibrium thermodynamic; and by an *organic natural system*, I mean any natural system such that it’s essentially or fundamentally uncomputable, negentropic, irreversible, processual, purposive, self-organizing, time-unidirectional or time-asymmetric, and non-equilibrium thermodynamic. But more specifically, by an *organismic system*, I mean any organic system that satisfies, **first**, the *Oxford Encyclopedic English Dictionary’s* non-scientific or non-technical definition of “organism,” namely,

**1** a living individual consisting of a single cell or of a group of interdependent parts sharing the life processes. **2a** an individual live plant or animal. **2b** the material structure of this. **3** a whole with interdependent parts compared to a living being. (Hawkins and Allen, 1991: p. 1024),

and **second**, this scientific or technical definition:

When the lipids in the primordial oceans generated micelles, they spontaneously separated the internal environment of the cell from the external environment .... That gave rise to intracellular negative entropy..., circumventing the Second Law of Thermodynamics, energized by chemiosmosis and regulated by homeostasis. These... are “The First Principles of Physiology” (FPP).... The organism complies with these FPPs by monitoring the environment based on the principle of homeostasis. There is a range of conditions that homeostasis can tolerate, beyond which remodeling of the cellular niches

formed by developmental causal-processual mechanisms occur.... Such auto-engineering underpins evolution.... The organism must ascribe to The FPPs to survive, making this fact a necessary feature of its nature. Conversely, homeostasis monitors the environment, providing freedom for the internal environment to vary around its set-point. If the limits of homeostatic control are violated, the organism will remodel itself by reverting to its previous phylogenetically determined set-point to maintain homeostasis. (Torday and Miller Jr, 2020: pp. 6-7; see also Varela, Maturana, and Uribe, 1974; Varela, 1979)

In turn, the fundamental distinction between organic systems and mechanical systems must be foregrounded against two fundamentally different worldviews: *the mechanistic worldview* and *the neo-organicist worldview*.

According to the mechanistic worldview, centered on the root metaphor of *the machine* (for example, in the 17<sup>th</sup> and 18<sup>th</sup> centuries, a *clock*, in the 19<sup>th</sup> century, a *steam engine*, and paradigmatically since the full emergence in the 1920s and 30s of what James C. Scott very aptly calls “high modernism,”<sup>1</sup> a Turing machine, i.e., a digital computer<sup>2</sup>), *everything in the natural universe is fundamentally either a formal automaton or a natural automaton*, operating strictly according to Turing-computable algorithms and/or time-reversible or time-symmetric deterministic or indeterministic laws of nature, especially the Conservation Laws (including the First Law of Thermodynamics) and the Second Law of Thermodynamics, which also imposes always-increasing entropy—i.e., the always-increasing unavailability of any system’s thermal energy for conversion into causal (aka “mechanical”) action or work—on all natural mechanisms, until a total equilibrium state of the natural universe is finally reached (see also Hanna and Paans, 2020).

By a diametric contrast, according to the neo-organicist worldview, centered on the root metaphor of *the living organism* (for example, a plant, an animal, and above all, rational, self-conscious minded animals like us), (i) everything in the world is essentially

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<sup>1</sup> See (Scott, 1998: p. 4):

[High modernism] is best conceived as a strong, one might even say muscle-bound, version of the self-confidence about scientific and technical progress, the expansion of production, the growing satisfaction of human needs, the mastery of nature (including human nature), and, above all, the rational design of social order commensurate with the scientific understanding of natural laws.

And now, a century later, high modernism has hit a brick wall. Indeed, it’s not implausible to see the 2020s as the decade of *the mega-crisis of high modernism, the formal and natural sciences, the mechanistic worldview, alike*. See (Hanna and Paans, 2020; Hanna, 2024a).

<sup>2</sup> For explicit definitions of the notion of Turing machine and computability, see (Boolos and Jeffrey, 1989).

or fundamentally uncomputable, negentropic, processual, purposive, self-organizing, time-irreversible or time-asymmetric, and non-equilibrium thermodynamic, (ii) there is a basic metaphysical and ontological continuity, running from the Big Bang singularity to uncomputable, negentropic, time-asymmetric, non-equilibrium thermodynamic energy flows, to living organisms, to conscious minded animals, to rational, self-conscious minded animals with free will and practical agency, and finally to social institutions of all kinds (see also Torday, Miller Jr, and Hanna, 2020), and (iii) all mechanical systems whatsoever, whether formal or natural, are *nothing but systematic abstractions from*—that is, degenerate cases of, fragments of, or limiting cases of—fundamentally organic systems, and therefore all mechanical systems whatsoever are *logically or nomologically strongly supervenient on organic systems*.<sup>3</sup>

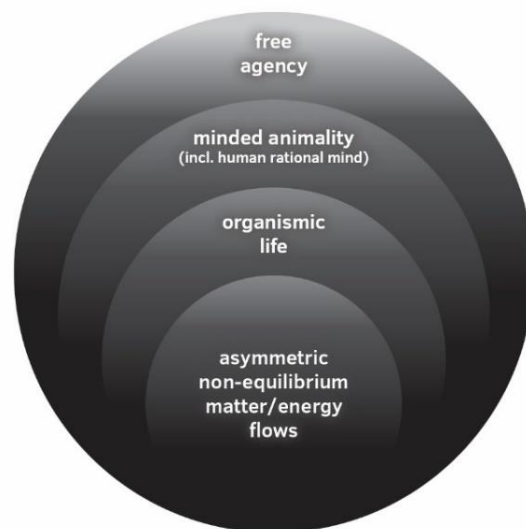
In turn, the neo-organicist worldview directly entails the metaphysical doctrine of *liberal naturalism* (Hanna and Maiese, 2009; Nagel, 2012; Hanna, 2018). Liberal naturalism says that the physically irreducible but also non-dualistic mental properties of rational human minded animals are at least as basic in nature as *biological* properties and any other *physical* properties, and metaphysically continuous with them. More precisely, according to liberal naturalism, rational human free agency is an immanent structure of essentially embodied, conscious (i.e., subjectively experiencing), self-conscious (i.e., conscious of its own consciousness, second-order conscious), caring (i.e., desiring, emoting, and feeling), sensibly cognitive (i.e., perceiving, remembering, and imagining), intellectually cognitive

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<sup>3</sup> Strong supervenience (Kim, 1993: esp. part 1; Horgan, 1993; Chalmers, 1996: chs. 1-3) is a necessary determination-relation between sets of properties or states of different ontological “levels,” a relation that is weaker than strict property/state-identity, and is usually taken to be asymmetric, although two-way or bilateral supervenience is also possible. But assuming for the purposes of simpler exposition that strong supervenience is asymmetric, then, more precisely, *B*-properties/states (= the higher level properties/states) strongly supervene on *A*-properties/states (= the lower-level properties/states) if and only if (i) for any property/state *F* among the *A*-properties/states had by something *X*, *F* necessitates *X*'s also having property/state *G* among the *B*-properties/states (upwards necessitation), and (ii) there cannot be a change in any of *X*'s *B*-properties/states without a corresponding change in *X*'s *A*-properties/states (necessary co-variation). It follows from strong supervenience that any two things *X* and *Y* share all their *A*-properties/states in common only if they share all their *B*-properties/states in common (indiscriminability). In turn, *logical* strong supervenience is a super-strong version of strong supervenience which says that the necessitation relations between the *B*-properties/states and the *A*-properties/states are *logical* and *a priori*. Or more simply put: The *B*-properties/states are “nothing more than” and “nothing over and above” the *A*-properties/states. If logical strong supervenience holds, then if there were such a being as an all-powerful and all-knowing creator God, and if They were to create and/or know all the *A*-properties/states, then They would have nothing more to do in order to create and/or know all the *B*-properties/states. By contrast to logical strong supervenience, *natural* or *nomological* strong supervenience is a modally weaker notion which says that the necessitation relations between the *B*-properties/states and the *A*-properties/states are determined by laws of nature, and hold in all and only the worlds in which those natural laws obtain.

(i.e., conceptualizing, believing, judging, and inferring), volitional (i.e., deciding, choosing, and willing), intentional more generally (i.e., object-directed or act-directed), human animal mind; essentially embodied conscious, self-conscious, caring, sensibly cognitive, intellectually cognitive, volitional, intentional more generally, free-agential human animal mind is an immanent structure of organismic life; and organismic life is an immanent structure of spatiotemporally asymmetric, uncomputable, negentropic, non-equilibrium thermodynamic matter/energy flows. Each more complex structure is metaphysically continuous with, and embeds, all of the less complex structures.

Again, and now put in terms of dynamic emergence, according to neo-organicism and its liberal naturalism, human free will and practical agency are dynamically inherent in and dynamically emerge from essentially embodied, conscious, self-conscious, caring, sensibly cognitive, intellectually cognitive, volitional, and more generally intentional human animal mind. And essentially embodied conscious, self-conscious, caring, sensibly cognitive, intellectually cognitive, volitional, and more generally intentional, human animal mind is dynamically inherent in and dynamically emerges from life. Therefore, human free will and practical agency are dynamically inherent in and dynamically emerge from life. Moreover, life is dynamically inherent in and dynamically emerges from spatiotemporally asymmetric, uncomputable, negentropic, non-equilibrium thermodynamic matter/energy flows. Therefore, human free will and practical agency, human mind, and life are all dynamically inherent in and dynamically emerge from spatiotemporally asymmetric, uncomputable, negentropic, non-equilibrium thermodynamic matter/energy flows. By way of a quick summary, here's a diagram of the basic metaphysical continuities and structural embeddings according to the neo-organicist, liberal naturalist conception:



Neo-Organicism (Hanna and Paans, 2020: p. 35; diagram created by Otto Paans)

For the record, and in the interests of full philosophical and scientific disclosure, I'm a strong proponent of the neo-organicist, liberal naturalist worldview (see, e.g., Hanna and Maiese, 2009; Hanna, 2018; Hanna and Paans, 2020; Torday, Miller Jr, and Hanna, 2020; Hanna, 2024a, 2024b). If I'm correct about this, then the mechanistic worldview is decisively *false* and the neo-organicist, liberal naturalist worldview is decisively *true*; and the revolutionary theoretical and social-institutional comprehension of this worldshaking dual fact is what I'll call *the neo-organicist revolution*.

One basic part of the neo-organicist revolution, which I call *the explanatory inversion thesis*, is the conceptual and theoretical *flip* of the modern-classical materialist or physicalist metaphysics and ontology of the mechanistic worldview, a flip according to which all mechanical systems whatsoever, whether formal or natural, are nothing but *systematic abstractions* from fundamentally organic systems, and not the other way around. Otherwise put, the explanatory inversion thesis says that all mechanical systems whatsoever are nothing but *degenerate cases, fragments, or limiting cases* within the fundamentally organic cosmos, and *do not* capture the fundamental informational or representational and causal structure of the cosmos.

By saying that all mechanical systems are "systematic abstractions" from fundamentally organic systems, I mean more specifically that all mechanical systems whatsoever are *either logically or naturally/nomologically strongly supervenient on* fundamentally organic systems. In turn, the logical or natural/nomological strong supervenience of mechanical systems on fundamentally organic systems entails that all mechanical systems, in and of themselves, are informationally/representationally and causally *inert*, i.e., informationally/representationally and causally *epiphenomenal*, with *no rich informational/representational powers or efficacious causal powers of their own*, because all rich informational/representational content and causal efficacy in the cosmos ultimately derives from and is inherited from organic systems: hence all mechanical systems are *informational/representational and causal parasites* or *informational/representational and causal shadows* of fundamentally organic systems. Correspondingly, all authentic knowledge (i.e., true and sufficiently justified belief) about mechanical systems consists in our (i) insightfully grasping the only-denumerable, recursive, entropic, deterministic/indeterministic, time-reversible or time-symmetric, equilibrium thermodynamic, and informationally/representationally-&-causally parasitic character of such systems, and their inherent limits, and then (ii) systematically embedding them within the essentially richer domains of organic systems.

According to the neo-organicist, liberal naturalist worldview, then, what is the explanatory and metaphysical or ontological function of mechanical systems? It's nothing more and nothing less than to provide a relatively fixed, rigid, and static *skeleton* for

channelling, distributing, focusing, framing, and more generally supporting the essentially richer informational or representational and causal powers of organic systems, just as the relatively fixed, rigid, and static skeleton inside a living animal channels, distributes, focuses, frames, and more generally supports the essentially richer informational or representational and causal powers of the organism itself. And when formal or natural organic systems fully unfold, naturally die, or otherwise creatively realize themselves and achieve closure, then the skeletons of their embedded mechanical systems continue to exist, either in a state of computable, decidable, recursive, and yet creatively inert formal perfection or else in a state in a state of calcified or frozen thermodynamic energy dispersal and equilibrium, i.e., *heat-death*. Therefore, trying to explain or construct organic systems from mechanical systems is *like confusing living animals with their skeletons*.

So, if the explanatory inversion thesis is true, then proponents of materialism or physicalism and the mechanistic worldview have committed what A.N. Whitehead aptly called *the fallacy of misplaced concreteness*: mistaking the abstract for the concrete (Whitehead, 1927/1967: p. 51), as if you could somehow explain or construct *living animals* by presenting their *skeletons*. Since proponents of materialism or physicalism and the mechanistic worldview start their theorizing with systematically abstracted, logically or naturally/nomologically strongly supervenient *abstracts* or *bare bones* of essentially richer formal or cosmological systems, and *mistakenly take those abstracts or bare bones to be concrete and fundamental*, then they've flagrantly committed the fallacy of misplaced concreteness.

Speaking now in moral and sociopolitical terms, the truly transformative, world-shaking moment in thinking, emoting or feeling, and acting, will be when people finally put the organic first, and not only *explicitly* and *self-consciously*, but also *intuitively* and *pre-reflectively consciously* situate mechanical systems within their limited sphere of efficacy exclusively, and thereby *firmly reject* and *resist* the mechanistic worldview. And that's when truly constructive, enabling social-institutional *mind-shaping* and *life-shaping* (Maiese and Hann, 2029; Maiese et al., 2023) will finally occur: when we've all *internalized* the neo-organicist revolution.

Now back to Bongard and Levin. Their argument presents an essentially *neo-organicist* line of thinking—

We see life from the organicist perspective.... We do not hold reductionist views of the control of life, and one of us (ML) has long argued against the exclusive focus on molecular biology as the only source of order in life... and the importance of multiple

lenses, including a cognitive one, on the problem of biological origins, causation, and biomedical interventions. (Bongard and Levin, 2021: Introduction, p. 1)

—yet rhetorically presents itself, trojan-horse-wise, as *new-age mechanism*, by blurring the original meanings of “organic system” and “mechanical system” by using the neologism, “the modern science of machine behavior”:

Progress in both theory and practical applications requires the establishment of a novel conception of “machines as they could be,” based on the profound lessons of biology at all scales. We sketch a perspective that acknowledges the remarkable, unique aspects of life to help re-define key terms, and identify deep, essential features of concepts for a future in which sharp boundaries between evolved and designed systems will not exist. (Bongard and Levin, 2021: abstract)

But in formal logic, even though there are (i) *consistent systems* (i.e., systems in which: there’s at least one interpretation such that all the sentences of the system are true, full stop; every sentence is either true or false, and no sentences are both true and false; there are no contradictions permitted as theorems of logic; and every sentence follows from a contradiction), (ii) *inconsistent systems* (i.e., systems in which: there’s no interpretation such that all the sentences of the system are true, full-stop; every sentence is both true and false; contradictions are permitted as theorems of logic; and every sentence follows from a contradiction) and (iii) *paraconsistent systems* (i.e., systems in which: there’s at least one interpretation such that all the sentences of the system are true, although not full-stop, since some sentences are both true and false; not every sentence is both true and false; contradictions are permitted as theorems of logic; and not every sentence follows from a contradiction), it doesn’t follow that the fundamental distinction between consistent and inconsistent logical systems is blurred by the existence of paraconsistent systems. On the contrary, the very idea of paraconsistent systems makes sense only by virtue of its presupposing the fundamental distinction between consistent systems and inconsistent systems. Then, studying paraconsistent systems simply draws our formal scientific and philosophical attention to the existence of non-classical *fused* or *hybrid* logical systems, i.e., *logical centaurs*, as it were, for the purposes of enriching and extending our concept and general theory of formal logic (see, e.g., Priest, 1998, 2001).

In a precisely analogous way, the existence of natural systems that are *paraorganic* (i.e., fundamentally organic plus some mechanical parts) or *paramechanical* (i.e., fundamentally mechanical plus some organic parts) doesn’t blur the fundamental distinction between organic systems and mechanical systems. On the contrary, the very ideas of paraorganic systems and paramechanical systems make sense only by virtue of their presupposing the fundamental distinction between organic systems and mechanical



systems. Then, studying paraorganic and paramechanical systems simply draws our natural-scientific and philosophical attention to the existence of non-classical *fused* or *hybrid* natural systems, i.e., *natural-systemic centaurs*, as it were—see, for example, the image displayed at the top of this essay, provided by Levin’s own lab—for the purposes of enriching and extending our concept and general theory of natural systems.<sup>4</sup>

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<sup>4</sup> I’m grateful to Jack Leissring for reminding me to be fully explicit about my commitments in the titanic debate between fundamentally different philosophical and scientific worldviews; to Joseph Wayne Smith for drawing my attention to Levin’s work; and especially to Otto Paans for thought-provoking correspondence on and around the main topics of this essay. See also (Hanna and Paans, 2020).

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